



# DYNAMIC PRESSURE SENSORS FOR HIGH FREQUENCY MEASUREMENTS

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## DYNAMIC PRESSURE SENSORS FOR HIGH FREQUENCY MEASUREMENTS

### EXTREMELY FAST, MICRO-SECOND RESPONSE WITH WIDE AMPLITUDE & FREQUENCY RANGE

Series 113B and 102B high frequency dynamic pressure sensors are structured with naturally piezoelectric, stable quartz sensing elements that are well-suited to measure rapidly-changing pressure over wide amplitude and frequency ranges. They feature micro-second response times and high resonant frequency. Solid-state construction, acceleration compensation, hermetically-sealed housings, and laser-welded flush diaphragms provide undistorted high frequency response and durability in adverse environmental conditions. ICP<sup>®</sup> technology provides a high signal-to-noise ratio and high-level voltage output, capable of driving long cables to a safe zone for data acquisition. Charge output sensors are also available for applications requiring continuous high operating temperatures. Piezoelectric sensors are more stable, robust, and use less costly signal conditioning than comparable piezoresistive types for dynamic pressure measurements.

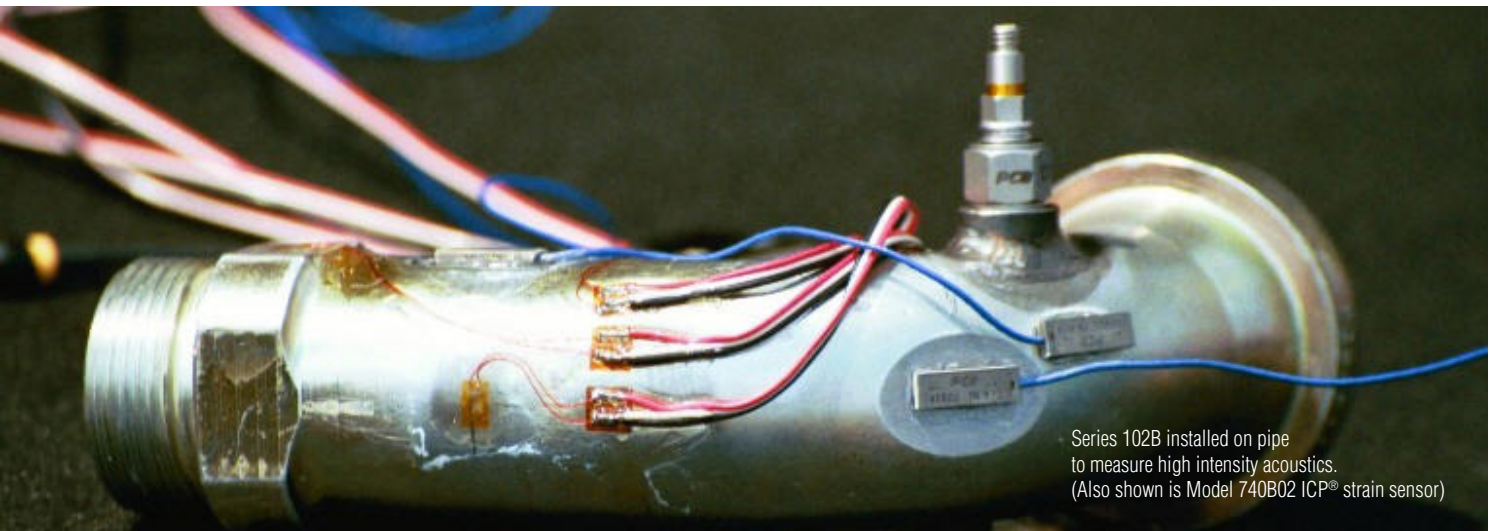
### APPLICATIONS

- Shock tubes and closed bombs
- Time-of-arrival measurements
- Explosion, blast, and shock wave

### HIGHLIGHTS

- Ultra-high frequency > 500 kHz
- Fast rise time < 1  $\mu$ sec
- Peak pressure and total impulse





Series 102B installed on pipe to measure high intensity acoustics. (Also shown is Model 740B02 ICP® strain sensor)

Typical applications include pulsations, hydraulic and pneumatic pressure fluctuations (e.g. compressors), fluid-borne noise detection, cavitation, high intensity acoustics, closed bomb combustion studies, explosive component performance (e.g. detonators, explosive bolts) and airbag testing. A popular application includes measurement of free field, enclosed, and directed (shock tube) air blast resulting from explosions or muzzle blast. Air blast over pressure and reflected pressure measurements can be measured to determine peak pressure, and total impulse of the structural loading imparted on any unit under test (e.g., building, ground transport vehicle, surface or underwater vehicle).

Series 113B and 102B pressure sensors are available with ranges to 15 kpsi (103 MPa) and sensitivities to 100 mV/psi (14.5 mV/kPa). Each sensor is supplied with NIST-traceable, A2LA accredited dynamic calibration to ISO17025. They are 100% in-process tested for resonant frequency, rise time, and acceleration compensation before shipment to the customer.

As with all PCB® instrumentation, these sensors are complemented with toll-free applications assistance, 24-hour customer service, and is backed by a no-risk policy that guarantees satisfaction or your money refunded.

CE



### HIGH FREQUENCY PRESSURE SENSOR

MODEL 113B

CE



### HIGH FREQUENCY PRESSURE SENSOR

MODEL 102B

CE



### HIGH FREQUENCY PRESSURE SENSOR

SERIES CA102B

Ablative coating option 'CA' available for flash protection

# ADDITIONAL SENSORS FOR HIGH FREQUENCY PRESSURE MEASUREMENTS

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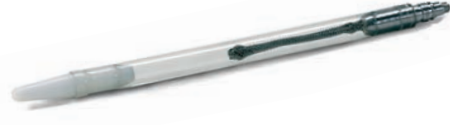


## ICP® FREE-FIELD BLAST PENCIL PROBES

SERIES 137

- Ranges from 50 to 5000 psi (344 to 34475 kPa)
- Rise time <4  $\mu$ sec
- Resonant frequency >500 kHz

CE



## ICP® UNDERWATER BLAST EXPLOSION PRESSURE PROBES

SERIES 138

- Ranges from 1000 to 50k psi (6894 to 344740 kPa)
- Rise time <1.5  $\mu$ sec
- Resonant frequency >1 MHz



## SHOCK WAVE TIME-OF-ARRIVAL ICP® MICROSENSORS

SERIES 132

- 50 psi (344 kPa) range
- Rise time <3  $\mu$ sec
- Resonant frequency >1 MHz
- 0.124" (3.15 mm) diameter diaphragm

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## TOURMALINE PRESSURE BAR

SERIES 134

- Designed for reflected shock wave pressure measurement
- Unique non-resonating design, tourmaline sensing element
- Pressure ranges from 1000 to 20k psi (6894 to 137900 kPa)
- Rise time  $\leq$  0.2  $\mu$ sec

## MOUNTING ADAPTERS



### MOUNTING ADAPTOR

SERIES 061A / 062A

- 061A01: 3/8-24
- 061A10: M10
- 062A01: 1/8-NPT



### MOUNTING ADAPTOR

MODEL 061A59

- 3/8-24 Delrin, Ground Isolated



### WATER-COOLED ADAPTOR

MODEL 064B02

- Flush Mount

## RECOMMENDED SIGNAL CONDITIONERS

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### SIGNAL CONDITIONER

MODEL 482A21

- Single & 4-channel versions
- Unity gain, low-noise, AC and DC powerable
- 1 MHz response

CE

TEDS  
RESISTANCE  
COMPATIBLE



### SIGNAL CONDITIONER

SERIES 482C & 483C

- AC-powered, 4- & 8-channel versions
- Variety of gain & filtering configurations
- Can operate with charge output sensors
- 1 MHz response (482C05 and 483C05 models only)

CE

TEDS  
RESISTANCE  
COMPATIBLE



### SIGNAL CONDITIONER

SERIES 481A

- AC-powered, 16-channel
- Many configuration options
- Can operate with charge output sensors
- Daisy-link multiple racks for up to 256 channels
- 1 MHz response (481A20 model only)

# SPECIFICATIONS

| DYNAMIC PRESSURE SENSORS FOR HIGH FREQUENCY   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|
| Model Number  | 113B28  | 113B27  | 113B21  | 113B26  | 113B24  | 113B22  | 113B23  | 113B03  |
| Measurement Range (+/- 5 Volt Output)   | 50 psi<br>345 kPa                                 | 100 psi<br>690 kPa                                | 200 psi<br>1380kPa                                | 500 psi<br>3450 kPa                               | 1 kpsi<br>6895 kPa                                | 5 kpsi<br>34475 kPa                               | 10 kpsi<br>68950 kPa                              | 15 kpsi<br>103420 kPa                             |
| Useful Overrange (+/- 10 Volt Output)   | 100 psi [1]<br>690 kPa [1]                        | 200 psi [1]<br>1380 kPa [1]                       | 400 psi [1]<br>2758 kPa [1]                       | 1 kpsi [1]<br>6895 kPa [1]                        | 2 kpsi [1]<br>13790 kPa [1]                       | 10 kpsi [1]<br>68950 kPa [1]                      | —   | —   |
| Sensitivity   | 100 mV/psi<br>14.5 mV/kPa                         | 50 mV/psi<br>7.25 mV/kPa                          | 25 mV/psi<br>3.6 mV/kPa                           | 10 mV/psi<br>1.45 mV/kPa                          | 5 mV/psi<br>0.725 mV/kPa                          | 1 mV/psi<br>0.145 mV/psi                          | 0.5 mV/psi<br>0.073 mV/kPa                        | 0.44 pC/psi<br>0.064 pC/kPa                       |
| Maximum Pressure  | 1 kpsi<br>6895 kPa                                | 1 kpsi<br>6895 kPa                                | 1 kpsi<br>6895 kPa                                | 10 kpsi<br>68950 kPa                              | 10 kpsi<br>68950 kPa                              | 15 kpsi<br>103420 kPa                             | 15 kpsi<br>103420 kPa                             | 15 kpsi<br>103420 kPa                             |
| Resolution  | 0.5 mpsi<br>0.0034 kPa                            | 1 mpsi<br>0.007 kPa                               | 1 mpsi<br>0.007 kPa                               | 2 mpsi<br>0.014 kPa                               | 20 mpsi<br>0.138 kPa                              | 20 mpsi<br>0.138 kPa                              | 40 mpsi<br>0.28 kPa                               | 10 mpsi [3]<br>0.07 kPa [3]                       |
| Resonant Frequency  | ≥ 500k Hz   | ≥ 500k Hz   | ≥ 500k Hz   | ≥ 500k Hz   | ≥ 500k Hz   | ≥ 500k Hz   | ≥ 500k Hz   | ≥ 500k Hz   |
| Rise Time (Reflected)   | ≤ 1 μsec  | ≤ 1 μsec  | ≤ 1 μsec  | ≤ 1 μsec  | ≤ 1 μsec  | ≤ 1 μsec  | ≤ 1 μsec  | ≤ 1 μsec  |
| Low Frequency Response (-5 %)   | 0.5 Hz  | 0.5 Hz  | 0.5 Hz  | 0.01 Hz   | 0.005 Hz  | 0.001 Hz  | 0.0005 Hz   | —   |
| Non-linearity   | ≤ 1 % [2]   | ≤ 1 % [2]   | ≤ 1 % [2]   | ≤ 1 % [2]   | ≤ 1 % [2]   | ≤ 1 % [2]   | ≤ 1 % [2]   | ≤ 1 % [2]   |
| Acceleration Sensitivity  | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) |
| Temperature Range   | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 | -400 to +400 °F<br>-240 to +204 °C                |
| Discharge Time Constant (at room temp)  | ≥ 1 sec   | ≥ 1 sec   | ≥ 1 sec   | ≥ 50 sec  | ≥ 100 sec   | ≥ 500 sec   | ≥ 1000 sec  | —   |
| Electrical Connector  | 10-32 jack  | 10-32 jack  | 10-32 jack  | 10-32 jack  | 10-32 jack  | 10-32 jack  | 10-32 jack  | 10-32 jack  |
| Housing Material  | 17-4 Stainless                                    | 17-4 Stainless                                    | 17-4 Stainless                                    | 17-4 Stainless                                    | 17-4 Stainless                                    | 17-4 Stainless                                    | 17-4 Stainless                                    | 17-4 Stainless                                    |
| Diaphragm Material  | Invar   | Invar   | Invar   | Invar   | Invar   | Invar   | Invar   | Invar   |
| Sealing   | Welded Hermetic                                   | Welded Hermetic                                   | Welded Hermetic                                   | Welded Hermetic                                   | Welded Hermetic                                   | Welded Hermetic                                   | Welded Hermetic                                   | Welded Hermetic                                   |
| ADDITIONAL VERSIONS   |   |   |   |   |   |   |   |   |
| All Invar Material  | 113B38  | 113B37  | 113B31  | 113B36  | 113B34  | 113B32  | 113B33  | —   |
| Stainless Steel Diaphragm   | S113B28   | S113B27   | S113B21   | S113B26   | S113B24   | S113B22   | S113B23   | —   |
| SUPPLIED ACCESSORIES  |   |   |   |   |   |   |   |   |
| Seal Rings: (3) 065A02 brass, 0.015 in. thick, (1) 065A05 stainless steel, 0.240 in. thick.                             |   |   |   |   |   |   |   |   |
| Clamp Nuts: (1) 060A03 English 5/16-24 thread, (1) 060A05 metric M7 thread  |   |   |   |   |   |   |   |   |
| NOTES   |   |   |   |   |   |   |   |   |
| [1] For +10 volt output, minimum 24 VDC supply voltage required. Negative 10 volt output may be limited by output bias. |   |   |   |   |   |   |   |   |
| [2] Zero-based, least-squares, straight line method.  |   |   |   |   |   |   |   |   |
| [3] Resolution dependent on signal conditioning and cable length used in charge system.                                 |   |   |   |   |   |   |   |   |

## GROUND ISOLATED, DYNAMIC PRESSURE SENSORS FOR HIGH FREQUENCY

| Model Number  | 102B18  | 102B16  | 102B15  | 102B06  | 102B04  | 102B  | 102B03  |
|---|---|---|---|---|---|---|---|
| Measurement Range<br>(+/- 5 Volt Output)  | 50 psi<br>345 kPa                                 | 100 psi<br>690 kPa                                | 200 psi<br>1380 kPa                               | 500 psi<br>3450 kPa                               | 1 kpsi<br>6895 kPa                                | 5 kpsi<br>34475 kPa                               | 10 kpsi<br>68950 kPa                              |
| Useful Overrange<br>(+/- 10 Volt Output)  | 100 psi [1]<br>690 kPa [1]                        | 200 psi [1]<br>1380 kPa [1]                       | 400 psi [1]<br>2758 kPa [1]                       | 1 kpsi [1]<br>6895 kPa [1]                        | 2 kpsi [1]<br>13790 kPa [1]                       | 10 kpsi [1]<br>68950 kPa [1]                      | —   |
| Sensitivity   | 100 mV/psi<br>14.5 mV/kPa                         | 50 mV/psi<br>7.25 mV/kPa                          | 25 mV/psi<br>3.6 mV/kPa                           | 10 mV/psi<br>1.45 mV/kPa                          | 5 mV/psi<br>0.725 mV/kPa                          | 1 mV/psi<br>0.145 mV/psi                          | 0.5 mV/psi<br>0.073 mV/kPa                        |
| Maximum Pressure  | 1 kpsi<br>6895 kPa                                | 1 kpsi<br>6895 kPa                                | 1 kpsi<br>6895 kPa                                | 10 kpsi<br>68950 kPa                              | 10 kpsi<br>68950 kPa                              | 15 kpsi<br>103420 kPa                             | 15 kpsi<br>103420 kPa                             |
| Resolution  | 0.5 mpsi<br>0.0034 kPa                            | 1 mpsi<br>0.007 kPa                               | 1 mpsi<br>0.007 kPa                               | 2 mpsi<br>0.014 kPa                               | 20 mpsi<br>0.138 kPa                              | 20 mpsi<br>0.138 kPa                              | 40 mpsi<br>0.28 kPa                               |
| Resonant Frequency  | ≥ 500k Hz   | ≥ 500k Hz   | ≥ 500k Hz   | ≥ 500k Hz   | ≥ 500k Hz   | ≥ 500k Hz   | ≥ 500k Hz   |
| Rise Time (Reflected)   | ≤ 1 μsec  | ≤ 1 μsec  | ≤ 1 μsec  | ≤ 1 μsec  | ≤ 1 μsec  | ≤ 1 μsec  | ≤ 1 μsec  |
| Low Frequency Response (-5 %)   | 0.5 Hz  | 0.5 Hz  | 0.5 Hz  | 0.01 Hz   | 0.005 Hz  | 0.001 Hz  | 0.0005 Hz   |
| Non-linearity   | ≤ 1 % [2]   | ≤ 1 % [2]   | ≤ 1 % [2]   | ≤ 1 % [2]   | ≤ 1 % [2]   | ≤ 1 % [2]   | ≤ 1 % [2]   |
| Acceleration Sensitivity  | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) | ≤ 0.002 psi/g<br>≤ 0.0014 kPa/(m/s <sup>2</sup> ) |
| Temperature Range   | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 | -100 to +275 °F<br>-73 to +135 °C                 |
| Discharge Time Constant<br>(at room temp)   | ≥ 1 sec   | ≥ 1 sec   | ≥ 1 sec   | ≥ 50 sec  | ≥ 100 sec   | ≥ 500 sec   | ≥ 1000 sec  |
| Electrical Connector  | 10-32 jack  | 10-32 jack  | 10-32 jack  | 10-32 jack  | 10-32 jack  | 10-32 jack  | 10-32 jack  |
| Housing Material  | 17-4 Stainless                                    | 17-4 Stainless                                    | 17-4 Stainless                                    | 17-4 Stainless                                    | 17-4 Stainless                                    | 17-4 Stainless                                    | 17-4 Stainless                                    |
| Diaphragm Material  | Invar   | Invar   | Invar   | Invar   | Invar   | Invar   | Invar   |
| Sealing   | Welded Hermetic                                   | Welded Hermetic                                   | Welded Hermetic                                   | Welded Hermetic                                   | Welded Hermetic                                   | Welded Hermetic                                   | Welded Hermetic                                   |
| <b>ADDITIONAL VERSIONS</b>  |   |   |   |   |   |   |   |
| Metric Mounting Thread  | M102B18   | M102B16   | M102B15   | M102B06   | M102B04   | M102B   | M102B03   |
| <b>SUPPLIED ACCESSORIES</b>   |   |   |   |   |   |   |   |
| Seal Rings: (3) 065A03 brass 0.030 in. thick.   |   |   |   |   |   |   |   |
| <b>NOTES</b>  |   |   |   |   |   |   |   |
| [1] For +10 volt output, minimum 24 VDC supply voltage required. Negative 10 volt output may be limited by output bias. |   |   |   |   |   |   |   |
| [2] Zero-based, least-squares, straight line method.  |   |   |   |   |   |   |   |



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